Patented Dec. 22, 1942 2,305,947

UNITED STATES PATENT OFFICE

2,305,947

DIFFUSION PUMP

Raymond W. Armstrong and Warren G. Taylor, Chicago, Ill., assignors to Taylor Tubes Inc., Chicago, Ill., a corporation of Illinois

Application August 12, 1942, Serial No. 454,564

3 Claims. (Cl. 230—101)

This invention relates to a diffusion pump of the mercury type used for the production of high vacua. In exhausting devices such as lamps, vacuum tubes, neon signs, and the like requiring extremely high vacua, it is customary to provide one or more mechanical exhaust pumps in series with a mercury diffusion pump. The mercury diffusion pump is connected directly to the article to be exhausted.

As a rule, mercury diffusion pumps are inefficient and slow for pressure differentials higher than a few millimeters of mercury. Hence, the initial exhausting is carried out by one or more mechanical exhaust pumps pulling air or other gas from the article being exhausted through the diffusion pump. As soon as the pressure has dropped to several millimeters of mercury, for example about two or three millimeters of mercury, the diffusion pump begins to be effective. The mechanical pump, while operating, functions as a sink or discharge for the diffusion pump.

Thus, a diffusion pump backed up by a mechanical exhaust pump may be utilized for obtaining vacua of the order of one or two thousandths of a millimeter of mercury. Pumps of this type as a rule have a mercury boiler and jets which impel gas particles. A mercury diffusion pump is provided with a water jacket for condensing mercury vapor. It has been the practice to confine the jacketing to parts of the pump only and leave the boiler wall open to air. As a result the construction has been expensive and complicated and considerable heat from the boiler was wasted. Since a diffusion pump of this type can only operate against low pressure differentials it is desirable to have several stages of such pumps. The provision of a single pump having several stages has usually involved complicated glass construction making for great expense and resulting in fragile structure.

By virtue of this invention, a mercury diffusion pump is provided which has no special water jacket but which may be set in water. Though the boiler may be in water yet the boiler construction is highly efficient so that all of the heat necessary is retained in the boiler. Furthermore, the structure is simple and may be made by a glass-blower with comparative ease. This invention further provides a simple construction for the pump proper wherein the complexity of glass work usually incident is entirely eliminated.

Referring now to the drawing, Figure 1 is a sectional elevation of a pump embodying this invention. Figure 2 is a section on line 2—2 of Figure 1. Figure 3 is a section on line 3—3 of Figure 1. Figure 4 is a section on line 4—4 of Figure 1.

The pump in general comprises a bottom boiler section 10 above which is disposed the diffuser pump section 11 the top of which carries an intake section 12 and the bottom of which carries a discharge section 13.

Referring first to boiler section 10, an outer envelope 15 is provided having a reentrant portion 16 terminating in a press 17. Mounted in press 17 is a pair of lead in wires 18 and 19 whose inner ends carry an electric heating element 20. Heating element 20 may be of any type whatsoever and as shown here is generally elongated. Section 10 has a top portion 21 carrying a tubular section 22 within section 10. Tubular section 22 extends downwardly toward press 17 and is turned back on itself at 23 to provide a reentrant cover portion 24 enclosing heater 20. Between reentrant portion 24 and tubular section 22 an annular chamber 25 is formed within which a quantity of mercury not shown may be disposed. The region around section 22 within the outer section 10 forms an annular chamber 27 which is preferably exhausted to a high vacuum. As is evident from Figure 1, chamber 27 is sealed both from atmosphere and from inner annular chamber 25.

The top portion of tube 22 carries a short cylindrical vapor discharge nozzle 28 extending upwardly away from the boiler. Disposed around discharge nozzle 28 is a flared foot portion 29 of an elongated diffusing tube 30. Diffusing tube 30 is closed at the upper end 31 and is provided with a bore 32 throughout the length thereof to the closed end. At spaced regions, here shown as two separate regions, a plurality of series of diffusing apertures 33 and 34 respectively may be provided giving access from the inside of the diffusing tube to the outside thereof. Thus, as shown, four apertures 33 are provided at the upper end of the diffusing tube 30 while four apertures 34 are provided at the middle portion of the diffusing tube. The number of apertures is unimportant and may be varied. It will be noted that apertures 33 are substantially larger in size than apertures 34 and this difference is due to the fact that series 33 constitute a first stage while series 34 constitute a second stage.

Around each series of diffusion apertures, there is provided a baffle 35 and 36 respectively of generally cylindrical shape, spaced from tube 30 and extending downwardly toward the boiler. Diffusing tube 30 has the bottom enlarged portion 29 provided with a plurality of small feet